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FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 54

[WC Docket No. 16-271; DA 22-484; FR ID 86215]

Wireless Telecommunications Bureau Adopts Drive Test Parameters and Model for Alaska Plan Participants

AGENCY: Federal Communications Commission.

ACTION: Final order; Alaska Plan.

SUMMARY: In the document, the Wireless Telecommunications Bureau (Bureau) of the Federal Communications Commission (Commission) adopts the drive test parameters and a drive test model required of two Alaska Plan mobile-provider participants: GCI Communication Corp (GCI) and Copper Valley Wireless (CVW). The Bureau also requests comment on requiring these mobile providers to submit new drive-test data if they fail to demonstrate compliance with their approved performance plan.

DATES: The Order is adopted and effective on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

FOR FURTHER INFORMATION CONTACT: For additional information on this proceeding, contact Matthew Warner of the Wireless Telecommunications Bureau, Competition & Infrastructure Policy Division, Matthew.Warner@fcc.gov, (202) 418-2419.

SUPPLEMENTARY INFORMATION: This is a summary of the "Order" portion of the Bureau's Alaska Plan Drive Test Order and Request for Comment, adopted on May 5, 2022, and released on May 5. 2022. The "Request for Comments" portion is published elsewhere in this issue of the *Federal Register*. The full text of this document is available for public inspection on the Commission's website at: https://www.fcc.gov/document/alaska-drive-test-order-and-request-comment.

I. INTRODUCTION

1. In the Order portion of this document, the Wireless Telecommunications Bureau (Bureau) adopts a drive-test model and parameters for the drive tests that are required of certain mobile providers participating in the Alaska Plan. The Bureau will use these drive-test data to determine whether mobile providers that receive more than $5 million in annual support for the deployment of mobile voice and broadband service in remote areas of Alaska have met their performance commitments. In the Request for Comment portion of the document, we seek comment on a proposal to require mobile-provider participants subject to the drive-test requirement to submit new drive-test data consistent with the drive-test model and parameters if they fail to meet a buildout milestone and later seek to cure a compliance gap.

II. BACKGROUND

2. Unique circumstances in Alaska make deploying communications infrastructure particularly challenging in that state. In the 2016 Alaska Plan Order, the Commission adopted an Alaska-specific, 10-year universal service plan to address these unique circumstances. The Alaska Plan Order froze mobile-wireless service-provider participants' preexisting support at December 2014 levels (frozen support) and sought to have those providers commit to expand Fourth-Generation, Long-Term Evolution (4G LTE) service at speeds of at least 10/1 Mbps in eligible areas, subject to certain exceptions (such as where middle-mile infrastructure capability is limited). In areas with limited middle-mile infrastructure, providers were allowed to make a lesser commitment until better middle-mile infrastructure became available.

3. Provider Commitments. Eight mobile providers chose to participate in the Alaska Plan and submitted for Bureau approval performance plans in which they committed to provide mobile voice and broadband services to delineated populations in remote eligible areas of Alaska. Providers, as part of their performance plans, were required to identify both the last-mile mobile technology (e.g., 3G, 4G LTE) that they would use to serve delineated populations and the type of middle-mile connectivity (e.g., fiber, satellite) on which they would rely to provide mobile services. Where Alaska Plan participants

could provide fiber-based 4G LTE, their speed commitments in those areas were greater than or equal to speed commitments with other technology combinations, consistent with the deployment standard set forth in the Alaska Plan Order (4G LTE at speeds of at least 10/1 Mbps). For those areas where the provider had to provide service over a performance-limiting satellite backhaul connection, the Bureau permitted providers to commit to previous-generation last-mile technologies and slower speeds.

4. Each participating mobile provider committed to meet buildout requirements at the end of year five (ending December 31, 2021) and year 10 (ending December 31, 2026) of the Alaska Plan and to certify that it met the obligations contained in the performance plan at each of these buildout milestones. The Commission stated that it would rely on participating providers' FCC Form 477 data—which report inter alia mobile wireless broadband coverage by technology and minimum advertised or expected speed —in determining whether the providers' five-year and 10-year milestones have been met. The Commission delegated authority to the Bureau to require additional information necessary to establish clear standards for determining whether providers have met their five and 10-year commitments.

5. Drive Tests. Mobile participants that receive more than $5 million annually in Alaska Plan support must accompany their milestone certifications with drive-test data. The drive-test data must show mobile transmissions to and from the network that meet or exceed the minimum speeds set out in the approved performance plans in the areas where support was received. The Alaska Plan Order specifies that these participants "may demonstrate coverage of an area with a statistically significant number of tests in the vicinity of residences being covered." Given the unique terrain and lack of road networks in remote Alaska, providers may conduct drive tests by means other than automobiles (such as snow-mobiles or other vehicles appropriate to local conditions). Two of the eight mobile participants—GCI Communications Corp. (GCI) and Copper Valley Wireless (CVW)—exceed the $5 million annual support threshold, and accordingly, they must provide drive-test data supporting the speed certifications consistent with their performance plan commitments.

6. Alaska Drive-Test Parameters and Model. In the Alaska Drive Test Public Notice, the Bureau proposed a model for conducting the drive testing (Alaska Drive-Test Model), which included the drive-test information to be submitted and the format in which it should be submitted. The parameters proposed in the Notice included, for example, the submission of latitude and longitude coordinates to identify the location of the test, a timestamp for the time the test was taken, the type of device and related software used for the test, last-mile technology tested, and recorded download and upload speeds.

7. The proposed Alaska Drive-Test Model was designed to ensure that the service providers required to conduct drive testing would obtain a "statistically significant number of tests in the vicinity of residences being covered." The proposed Alaska Drive-Test Model uses stratified random sampling to determine test locations within a grid system based on the service provider's reported coverage area. Under the proposal, the Commission would begin with the populated areas contained in the performance plans for each type of technology and backhaul and then overlay a one-square kilometer grid system to create a frame around the covered populated area corresponding with the performance commitments. Staff would then stratify the frame into sets of grids determined by statistical formulae based on theoretical population of the grid cells (e.g., lowest population grid cells would be in the first stratum; highest population grid cells would be in the highest-numbered stratum) and would select a random sample of grid cells for testing from each stratum within the frame. The Bureau proposed that, within each grid cell, a service provider would conduct a minimum of 20 tests, consisting of download and upload components, no less than 50% of which would be conducted from a vehicle while in-motion. To be considered valid, each test would have to be conducted between the hours of 6 a.m. and 10 p.m. within the selected grid cell, and the test data would have to report all relevant parameters. Staff would construct a confidence interval for the drive-test results that would be used to verify that a provider's commitments have been met or to determine the percentage by which the provider has failed to meet its commitments.

8. The Bureau sought comment on the parameters and proposed Alaska Drive-Test Model and on any alternatives that it should consider. GCI filed comments, and both GCI and CVW made ex parte presentations to staff about the proposed Alaska Drive-Test Model. No other party filed comments or made such presentations. Based on concerns that were expressed about the initial deadline, the Bureau extended the drive-test data-submission deadline, moving it from March 1, 2022 to September 30, 2022. The Commission will continue to monitor the situation and will remain flexible where warranted.

III. DISCUSSION

9. We adopt the proposed parameters and the proposed Alaska Drive-Test Model with the modifications specified below. We will use data derived from these parameters, combined with FCC Form 477 coverage data and complementary middle-mile data, to verify that covered service providers have met their commitments. Upon submission of the drive test data that we discuss in this Order, a corporate officer of the mobile-provider participant must certify to the data's accuracy, consistent with the obligations of 47 CFR 54.321(a). When submitting the drive test data, a corporate officer of the mobile-provider participant must submit this certification: "I certify that I am an officer of the reporting carrier; my responsibilities include ensuring the accuracy of certifications which are required to be reported pursuant to 47 CFR 54.321(a). The reporting carrier certifies that the data received or used from drive tests analyzing network coverage for mobile service pursuant to 47 CFR 54.321(a) are complete, accurate, and free from misrepresentation." The Commission staff will provide details to GCI and CVW on how to submit the drive test data.

A. Drive-Test Parameters

10. We adopt a modified version of the drive-test parameters proposed in the Alaska Drive Test Public Notice (attached as Appendix A). These parameters specify the categories of data to be collected as well as the data structure and format in which the data must be reported. In addition to the parameters the Bureau proposed, the Bureau adopts other changes to the parameters; most notably, we have altered the parameters in Appendix A with respect to the data to be collected for 2G/Voice. In

the Notice, the Bureau proposed that, for 2G, a data rate of 22.8 kbps or higher for download and upload tests would be appropriate because that should be a minimally sufficient speed to provide a serviceable voice call. GCI expressed concern that speed-test data would not accurately represent the ability to place a voice call over a 2G network, particularly for non-GSM standards such as CDMA or UMTS. GCI proposed that, instead, providers demonstrate voice coverage by placing voice calls between five and 30 seconds in duration to a telephone number established for test calls.

11. We find GCI's suggestion to be a reasonable approach, and therefore we will require it instead of the approach we proposed in the Notice. Because GCI is the only provider subject to drive testing that has a 2G commitment and GCI's particular 2G requirement is voice only, we agree with GCI that a test assessing the availability of voice service would be appropriate. Accordingly, GCI must use voice calls to demonstrate its "Voice/2G" coverage in areas that it is required to drive test, and Appendix A now includes parameters for voice-only testing. This change from the original proposal enables GCI to enter information that records a successful call completion using 2G technology, regardless of data rate, consistent with the voice-only commitment. The new fields for GCI's voice-only testing are the voice originating, voice terminating, rxlev, and rxqual fields. The voice originating field is a field for providing information for outbound calling and the voice terminating field is for receiving inbound calls for the testing. The rxlev and rxqual fields represent data elements that are necessary to determine the signal quality and strength and corresponding quality of the network for voice calls.

12. We also adopt other modifications to the proposed data specifications for mobile speed tests. As set forth in more detail in Appendix A, we modify the proposed data specifications to add new drive-test parameters within existing categories—specifically, device Type Allocation Code (TAC), warmup duration, warmup bytes transferred, spectrum band, and success flag. Most of the parameters that we altered—device TAC, warmup duration, warmup bytes transferred, and spectrum band—resulted from the Bureau's experience constructing the Broadband Data Collection but will also aid understanding of the data derived from the Alaska Plan drive tests. The device TAC provides the type of device used in the testing and helps us better understand the results, particularly if results indicate a

problem with a network that may be attributable to the type of device. The warmup bytes and duration are the bits recorded during the testing ramp-up time, and collecting ramp-up bits as a separate field is required to ensure we are accurately measuring the network's maximum transmission data rate. The spectrum band records the spectrum band or bands utilized during the drive test, which can affect wireless performance. Finally, because the drive tests need to exceed the minimum commitments in the mobile-provider participants' performance plans, the success flag field was added to record where the data indicate that the tests were successful to that end (or not).

B. Alaska Drive-Test Model

13. We adopt the proposed Alaska Drive-Test Model (attached as Appendix B), with limited clarifications and modifications. The Alaska Drive-Test Model uses a stratified random sample of a frame. A frame consists of the complete set of units within a commitment eligible to be sampled, which for the purposes of the Alaska Plan drive testing are one-square kilometer grids in which a provider has at least 100,000 square meters of covered populated area. The construction of this frame is a multi-part process. First, we will create a set of "eligible populated areas." Census blocks eligible for frozen-support funding would be included, and these census blocks would be merged with the populated areas of the Alaska Population-Distribution Model. Second, staff will merge the FCC Form 477 reported coverage areas (for which a provider committed to deploy and that are subject to testing) with the eligible populated areas to create a set of "covered populated areas." Third, Commission staff will overlay a grid of 1 km x 1 km squares onto the covered populated areas. Lastly, any grid cell that contains fewer than 100,000 square meters of covered populated area, or 10% of the grid cell, will be excluded from the frame.

14. The frame is divided into subsets of similar characteristics, called strata. This methodology allows fewer grid cells to be selected for testing while producing a statistically equivalent level of accuracy as sampling the entire frame, thus reducing the burden of testing. We will use the cumulative square root of the frequency (CSRF) method to define the breaks between strata based on a scale along the cumulated square root of the frequency of grid cells belonging to equal intervals of the stratification variable. Using the CSRF method will help to ensure that grid cells with low population are

confined to a single stratum within each frame. The number of strata for a frame depends on the number of grid cells in that frame and the distribution of the populations within the frame. Two to eight strata are likely to be necessary per frame.

1. Commitment-Based Frames

15. Frames are based on providers' commitments. In particular, Commission staff will create separate frames where a provider committed to different speeds based on different middle-mile or last-mile technologies in its Bureau-approved performance plan. CVW is subject to one frame because it committed to 10/3 Mbps 4G LTE in all of the areas where it receives Alaska Plan support. GCI is subject to five frames, as GCI committed to five different speeds based on various combinations of middle-mile and last-mile technologies:

- Fiber-based 4G LTE at a minimum speed of 10/1 Mbps;
- Microwave-based 4G LTE at a minimum speed of 2/.8 Mbps;
- Satellite-based 4G LTE at a minimum speed of 1/.256 Mbps;
- 3G or better at a minimum speed of .2/.05 Mbps; and
- Voice/2G.

16. GCI argues that, instead of basing frames on middle-mile and last-mile technologies, we should assign frames based only on the speeds a provider reports via its FCC Form 477 filings. GCI asserts that a speed-only approach better reflects the intent of the Alaska Plan Order and that the Commission intended to use information about middle-mile and last-mile technologies only to determine whether mobile carriers' proposed speed commitments were reasonable. Pointing to language in the Alaska Plan Order, which states that drive tests must show mobile transmissions that meet or exceed "the speeds delineated in the approved performance plans," GCI contends that the Bureau's drive-test proposal "changes the yardstick by which providers will be measured."

17. We disagree. The Alaska Drive-Test Model's integration of middle-mile and last-mile technologies is consistent with the Alaska Plan Order, the Commission's rules, the provider performance

plans that the Bureau approved, and the policy undergirding the Alaska Plan. In 2016, the Commission sought to advance, to the extent possible, the number of locations in Alaska that have access to at least 10/1 Mbps 4G LTE. It permitted the Bureau to approve lesser commitments "in particular circumstances" if a provider's ability to achieve 10/1 Mbps 4G LTE was limited, for example, by a lack of access to middle-mile infrastructure. In areas where such limitations did not exist, providers were expected to extend 4G LTE service, which was the latest mass-market technology available at the time the Commission adopted the Alaska Plan. Additionally, if backhaul becomes newly available in an area where a provider has not committed to provide 10/1 Mbps 4G LTE, then that provider must submit revised commitments that take into account the new backhaul option. While GCI argues that the Commission only intended to use information about middle-mile and last-mile technologies to determine whether mobile providers' proposed speed commitments were reasonable, GCI does not address how the Commission could determine whether a mobile provider has met those commitments without also collecting information about its speeds for each specified technology and middle-mile facility.

18. Contrary to GCI's assertions, we have not "change[d] the yardstick by which providers will be measured." To implement the framework described above, the Commission required providers to identify in their performance plans the populations that they proposed to cover at the five- and 10-year milestones, "broken down for each type of middle mile, and within each type of middle mile, for each level of data service offered." This approach is mirrored in the Commission's rules, which require mobile providers to build out to the "population covered by the specified technology, middle mile, and speed of service in the carrier's approved performance plan, by the interim milestone." In addition, every performance plan that providers submitted and the Bureau approved—including GCI's original plan and updated plans—identifies the providers' speed commitments based on available middle- and last-mile technology employed.

19. The Alaska Drive-Test Model, by taking into account middle- and last-mile technologies, will allow CVW and GCI to show that they have met the speed commitments delineated in their

approved performance plans. While GCI is correct that the drive-test data will demonstrate network throughput (i.e., speeds), the minimum speeds it is required to show are—and must be—"delineated" in its approved plan in terms of populations covered by specific combinations of middle- and last-mile technologies. GCI's suggested reading of the Commission's rules, in contrast, would require us to ignore the rules' repeated references to middle- and last-mile technologies in describing how providers are required to identify and meet their commitments. The Commission could have required in the Alaska Plan Order that providers base their commitments solely on speed criteria, but it explicitly required the inclusion of middle-mile and last-mile technology for the population served as part of the performance plans, consistent with the Commission's goal of expanding Alaskans' access to 10/1 Mbps 4G LTE technology to the greatest extent possible, unless an exception was warranted.

20. Moreover, failing to account for last-mile and middle-mile technologies in the Alaska Drive-Test Model could allow participants to skirt their commitments. For example, speed tests conducted in close proximity to a tower providing 3G service using microwave backhaul could produce test results of 10/1 Mbps or better. If that grid cell's population is credited toward a provider's fiber-fed 4G LTE performance obligation, this would offset the need for the provider to demonstrate 10/1 Mbps 4G LTE service in another area that should otherwise receive this level of service based on fiber-based middle-mile facilities.

21. Finally, we note that, under the Alaska Plan, approval of a provider's plan to maintain lower levels of technology "in particular circumstances . . . to a subset of locations" is limited to those locations; it is not a fungible token to provide lower levels of service anywhere in the provider's service area. In other words, a provider may not underperform in areas where it committed to 10/1 Mbps 4G LTE, even if it overperforms in areas where it was allowed a lesser commitment due to "unique limitations" in those areas. To the extent "unique limitations" no longer prevent a provider from achieving 10/1 Mbps 4G LTE in an area, the appropriate course of action would be for the provider to update its performance plan, as required under the terms of the Alaska Plan Order.

2. Grid Cells with No Roads

22. Some parts of remote Alaska lack any roads, and some large areas have a low population density. Nonetheless, providers committed to serve many of these areas, and they receive support from the Alaska Plan to do so. As discussed further below, we cannot ignore these areas when evaluating CVW's and GCI's performance commitments, and thus we find it necessary to include in the testing sample grid cells with no roads as well as grid cells with low populations, consistent with the Alaska Plan Order and our proposals in the Alaska Drive Test Public Notice. While we cannot ignore these areas when evaluating CVW's and GCI's performance commitments, we note that the Alaska Drive-Test Model includes a number of design features that should limit the areas without roads or with little population that the two providers must test, as we detail below.

23. We acknowledge that remote Alaska has unique challenges, including roadless areas, and these unique challenges are the reason the Commission created a separate universal service support mechanism for Alaska. Some of the roadless remote areas, however, are in the vicinity of covered residences and must be tested to achieve statistically significant testing of each provider's coverage sufficient to enable the Bureau to determine whether a provider has satisfied its commitments. A quality communications network is all the more essential where the local population lacks roads, and to the extent that providers have received universal service support to cover such populated areas, they are required to demonstrate their claimed coverage.

24. We also find it necessary to include in the testing sample grid cells with a modeled population of less than one person—including such grid cells with no roads—consistent with the Alaska Plan Order and our proposals in the Alaska Drive Test Public Notice. Providers committed to cover delineated eligible populations in their performance plans, including some areas that are sparsely populated. While providers only test populated areas, in some instances, the number of grid cells within the populated area of a census block can outnumber the people. Where the aggregate number of grid cells in a covered populated area exceed the number of people in that area, such grid cells will appear to have less than one person. However, to "demonstrate coverage of an area with a statistically significant

number of tests in the vicinity of residences being covered," these areas are necessary to test as part of the coverage that the provider committed to and receives support to provide mobile service.

25. GCI argues that it should not be required to test sparsely populated grid cells, and both GCI and CVW express concern that testing in grid cells with no roads will be extremely difficult. But the Alaska Drive-Test Model has design features that should help address concerns about these grid cells. The model stratifies each frame using CSRF based on grid-level estimates of covered population. This includes creating a single stratum within each frame of all grid cells with a population of less than one person. Further, the sample is apportioned across a frame using Neyman allocation, a technique that draws more samples from more highly populated strata relative to lower populated strata. Accordingly, the stratum containing grid cells with a population of one person or more will have a greater number of grid cells compared to strata containing grid cells of population less than one, and more samples will be drawn from the higher populated strata. This has a compounding effect that limits the number of grid cells with a population less than one that will be selected for testing. In addition, the Alaska Population-Distribution Model distributes population near roadways for census blocks that contain roads, making it more likely that areas near roads will be covered populated areas and selected for testing.

26. GCI claims that many testable grid cells are too sparsely populated for worthwhile testing. GCI's analysis of the Alaska Drive-Test Model claims that 53% of the grid cells would have less than one person and that based on GCI's analysis, 48% of grid cells would have less than one person per grid cell and no roads. GCI argues that grid cells with less than one person should be eliminated from testing and grid cells with no roads should be required sparingly, given the burdens of conducting drive testing. Similarly, CVW notes that some grid cells would be inaccessible mountains or islands with no public access. GCI evaluated the grid cells in its coverage areas and determined that 59% of the grid cells would have no roads, that 49% of the grid cells would be more than a mile from the nearest road, and that 12% of the grid cells would be more than ten miles from the nearest road.

27. GCI has not presented its data or the methodology underlying its calculations, and we were not able to reproduce it. However, for several reasons, we believe that GCI's calculations result in

significant over-estimates. First, the Alaska Drive-Test Model's de minimis population standard has the effect of reducing the number of grid cells without roads that would otherwise be included in the testing frame. Second, as noted above, we designed the sample and stratification so that there would be substantially more grid cells that are populated compared with grid cells with population less than one in the sampling methodology to increase the probability that a populated grid cell would be selected for testing compared with a grid cell with population less than one. Third, because there is a high correlation between populated grid cells and grid cells with roads, our sampling methodology should not only increase the percentage of populated grid cells that are tested but also increase the percentage of tested grid cells that have roads. Accordingly, for all of these reasons, we believe that GCI's calculations result in over-estimates.

28. We also disagree with GCI that the burdens of testing in these areas outweigh the benefits of testing in areas where GCI is receiving universal service support. If we excluded such grid cells in the sampling, GCI would continue to receive Alaska Plan support in remote areas of Alaska without adequate means to verify coverage, which runs contrary to the principles outlined in the Alaska Plan Order. Low population density and areas with no roads are features in many parts of remote Alaska—a fact of which CVW and GCI were aware when they elected to participate in the Alaska Plan—yet these providers nonetheless committed to covering these remote areas using universal service support. For these reasons, we decline to eliminate testing for grid cells with no roads, including those grid cells with a population of less than one. Although CVW and GCI must drive test some grid cells that do not have roads, the Commission foresaw this potential issue and accounted for it by allowing drive tests to be conducted "by means other than in automobiles on roads." We provide further relief for the providers by allowing use of unmanned aircraft systems (UASs), subject to the waivers we describe below.

a. Grid Cells with No Roads and Population of One or Greater

29. For the reasons described above, we find it necessary to require testing of grid cells with no roads and population of one or greater. To the extent a grid cell with a population of one or greater

does not include an accessible road, the accommodation to use off-road vehicles should improve testability. If there are instances where a mobile-provider participant claims that it cannot use on-the-ground, off-road vehicles to test such a grid cell, it may seek a waiver from the Bureau to use a UAS to test that particular grid cell. This waiver request should provide a statement regarding why good cause exists to waive the on-the-ground testing requirement for that grid cell, contain evidence supporting that claim, and be filed in WC Docket No. 16-271. UASs should mirror on-the-ground vehicles to the extent possible, matching on-the-ground vehicle speed (for example, matching nearby speed limits) and flying at the lowest, safest possible elevation, to best reflect on-the-ground usage. Additionally, UASs performing drive tests must: (1) at all times operate at less than 200 feet above ground in remote areas of Alaska where road-based testing is impractical/impossible; (2) limit power to the minimum necessary to accomplish testing; and (3) upon receipt of a complaint of interference from a co-channel licensee, notify the Commission and either remedy the interference or cease operations.

30. To the extent that a mobile provider seeks to use UASs to conduct testing, it may do so if the allocation and service rules permit airborne use of the spectrum that will be used to provide the mobile service to be tested as part of the drive tests. Otherwise, the provider must additionally obtain a waiver from the Commission (pursuant to Section 1.925) of any airborne limitations.

b. Grid Cells with No Roads and Population of Less than One

31. For the reasons described above, we also find it necessary to require testing of certain grid cells with no roads and population of less than one. However, as an alternative to testing with an automobile or other terrestrial off-road vehicle (e.g., snowmobile or all-terrain vehicle), we will allow use of UASs for the first, and least densely populated, stratum without requiring the waiver that we will require GCI and CVW to obtain to use UASs for testing grid cells with one or more people. GCI and CVW both express concern with drive testing where no roads exist. This additional UAS option is provided to address their concerns. Of the two to eight strata per frame, the first stratum contains the grid cells with less than one person per grid cell and no roads. As these grid cells are likely the most logistically difficult to test and may contain uninhabitable or untraversable terrain, the added flexibility offered by a

UAS without a waiver should make the testing easier for these areas. UAS performing drive tests must: (1) at all times operate at less than 200 feet above ground in remote areas of Alaska where road-based testing is impractical/impossible; (2) limit power to the minimum necessary to accomplish testing; and (3) upon receipt of a complaint of interference from a co-channel licensee, notify the Commission and either remedy the interference or cease operations. We note that while we will not require a waiver for use of UASs for testing these grid cells, we will require a waiver for use of any allocation or service rules that prohibit airborne use of the spectrum that will be used to provide the mobile service to be tested as part of the drive tests (consistent with the requirement we adopt above for use of UAS to test grid cells with no roads and a population of one or more people).

3. Distant Communities

32. GCI expresses concern that the number of "communities" that it needs to travel to is the biggest driver of its testing costs. GCI notes that there are 205 communities within its footprint and that, while GCI may be able to drive to some communities, "given the distances between communities and the lack of interconnected roads, [GCI's testing teams must] often [travel to these communities] by small aircraft." To the extent GCI has to charter a flight to many of these communities, this would increase the costs and complexities associated with drive testing all of its assigned grid cells.

33. To help reduce the burdens of traveling to many different communities, we have added an optimization to the sampling process that will likely reduce the number of incorporated and census designated places where GCI and CVW would have to travel. Given that GCI did not provide a definition of "communities," we believe incorporated and census designated places are the closest proxy, as there are 284 incorporated and census designated places in GCI's footprint, and incorporated and census designated places are integrated into census data, which are used throughout this modeling. We implement these additional steps in direct response to GCI's concerns and describe this additional process in Appendix B, infra.

4. In-Motion Testing Requirement

34. We adopt the proposal to require at least 50% of drive tests to be conducted while in motion. Requiring that 50% of the drive tests be conducted while in motion strikes a balance of ensuring that the drive tests are a sufficient representation of how consumers use their mobile devices, which is both in a stationary and in-motion environment. Requiring some in-motion tests also helps ensure that tests are conducted in multiple locations within the grid cell.

35. We disagree with GCI that the proposed in-motion requirement is unnecessary. The Alaska Plan Order referred to these as “drive tests,” which suggests some degree of motion consistent with a driving experience. The drive testing data to be submitted is to “show[ ] mobile transmissions to and from the network meeting or exceeding the speeds delineated in the approved performance plans.” Mobile service, as defined in the Communications Act and the Commission’s rules, supports an in-motion requirement for at least some drive tests. Moreover, requiring drive tests in motion is also consistent with the in-vehicle mobile propagation modeling that mobile broadband service providers must submit as part of the Broadband Data Collection, which providers could verify through on-the-ground data submitted in response to cognizable challenges and/or verification inquiries initiated by Commission staff. The Commission also explained for the Broadband Data Collection that it was important for consumers to be able to challenge mobile broadband service providers’ coverage in both stationary and in-vehicle (i.e., in-motion) environments. Because mobile service assumes a service that works with mobile stations that are designed to move and ordinarily do move, in-motion tests are necessary to ensure that mobile service is being provided.

36. GCI contends that in-motion tests from a non-standard road or a trail could be hazardous with little daylight and winter weather. The concerns posed by drive testing during winter weather are no longer relevant because we have moved the deadline for the data from March 1, 2022, to September 30, 2022. GCI further argues that an in-motion requirement is unnecessary because many grid cells lack roads and may not reasonably accommodate in-motion tests and, similarly, that many grid cells with roads have small populated areas, which makes it difficult to conduct a sufficient number of

in-motion tests. As noted previously, where roads are insufficient, the drive test model allows tests to be conducted by vehicles other than automobiles on roads. Further, we have limited the grid cells with small testing areas by removing from drive testing the de minimis grid cells with less than 100,000 square meters of covered populated area.

5. Early Upgraded Areas

37. Mobile service providers participating in the Alaska Plan are free to upgrade areas early with technologies beyond what they have committed to, notwithstanding the commitments set out in their performance plans. In the Alaska Drive Test Public Notice, the Bureau stated, for instance, that where providers have deployed 5G-NR, it would be included in the "LTE" frame. Moreover, GCI updated its performance plan twice based on commercial availability of new middle-mile infrastructure, consistent with the Alaska Plan Order requirements, but it did not commit to improve those areas by the five-year milestone (positioning itself to be able to upgrade those areas by the final, 10-year milestone instead).

38. GCI has noted that, in some areas, it "has deployed a more advanced technology but does not yet provide the speed associated with that technology or frame. For example, "an area served with fiber may have LTE technology, but the locations more distant from the tower . . . do not receive 10/1 Mbps." GCI claimed it "never expected that pops served with less than 10/1 Mbps would count toward the number of pops served at 10/1 Mbps but also never expected the Commission to disregard them completely for the purpose of assessing the number of pops served with 2/.8 Mbps or lower speeds." GCI also claimed that, if it believed all fiber areas upgraded to 4G LTE were required to have 10/1 Mbps or better, it would have delayed some of its 4G LTE deployments until year six or later and excluded those areas as appearing on its FCC Form 477 submission as having 4G LTE.

39. We agree with GCI that we should not punish providers for deploying 4G LTE to some areas earlier than they committed to in their performance plan at the five-year milestone. Accordingly, where 4G LTE is indicated on FCC Form 477 at less than 10/1 Mbps in fiber-based areas, those areas will be included in the 3G frame (3G or better frame) and will be attributed to 3G commitments. If we were

to include these areas (which may not yet be engineered to achieve 10/1 Mbps) in the fiber-based 4G LTE frame, then it could lead to higher fail rates in the frame. These higher fail rates would make GCI appear as if it had not met its commitments in places where GCI actually met (or exceeded) its five-year commitments. The approach we adopt will therefore avoid punishing GCI where it deployed 4G LTE early but was not ready to add those areas to its five-year commitments of 10/1 Mbps fiber-based LTE service. We will follow a similar approach for 4G LTE areas that would be included in the microwave and satellite 4G LTE frames. For example, if GCI deployed 4G LTE to a microwave-based area, as indicated by FCC Form 477 and corresponding middle-mile data, but GCI's FCC Form 477 filing shows minimum expected speeds as less than 2/.8 Mbps for such areas, then those areas will be included in the 3G or better frame. This clarification should ensure that GCI is being held to its commitments while not being penalized for deploying more advanced technology ahead of schedule.

6. Multiple Last-Mile Technologies in a Grid Cell

40. When multiple technologies overlap within a grid cell, Commission staff will attribute the overlapped area to the frame with the more advanced technology. For example, in grid cells where fiber-based 4G LTE at 10/1 Mbps and 3G completely overlap in a grid cell, staff will attribute the grid cell to the fiber-based 4G LTE frame for satisfaction of the fiber-based 4G LTE commitments. Attribution to the more advanced technology allows the provider to receive due credit where it has built out consistent with its most rigorous performance requirements. Alternatively, in grid cells where fiber-based 4G LTE at 10/1 Mbps only partially overlaps 3G coverage, staff will attribute the grid cell portion covered by fiber-based 4G LTE to the fiber-based 4G LTE frame and the remaining covered area of the grid cell to the 3G frame. In this instance, a grid cell could be contained in multiple frames.

41. GCI claimed that more than half of the cells within its covered populated areas have multiple or overlapping technologies. GCI argued that, where a grid cell is both in a 4G LTE and 3G frame, once it passes for 4G LTE, the grid cell should be removed from the 3G frame so that pops in the 3G frame are not attributed as a "fail."

42. We clarify that if a grid cell is selected for both 4G LTE and 3G testing, staff would evaluate both selections from the same drive tests. If the drive tests show that GCI passes the 4G LTE standard for that grid cell, then GCI will also receive credit for that grid cell passing the 3G standard; thus, GCI would not receive a "fail" for the 3G selection, obviating the need to remove the grid cell from the 3G frame. If, however, the testing threshold only passes for the 3G requirements, then the grid cell would be attributed as a "pass" to 3G but a "fail" as to 4G LTE, consistent with the pass/fail approach described below.

7. Pass/Fail Approach

43. We adopt the pass/fail approach to testing for the Alaska Drive-Test Model proposed in the Alaska Drive Test Public Notice. For each grid cell in the sampling frame, the results of the tests will establish whether the provider delivers coverage at the minimum speeds to which it committed. When replicated throughout all of the randomly selected grid cells that are required for testing, the Commission will evaluate the percentage of the provider's coverage area where it has met its commitments. To demonstrate coverage in an area with a statistically significant number of tests, the Alaska Drive-Test Model requires the tests to pass at a rate capable of ensuring that the provider has met its milestones.

a. Pass/Fail Testing

44. We adopt the following pass/fail methodology for the Alaska Drive-Test Model: 85% of drive test results in a grid cell must show speeds that meet or are above the minimum committed-to speed for that frame in order for the service to be considered "available" in that grid cell. Successful tests measure whether a mobile-provider participant meets a minimum expected speed in a given grid cell, with "expected" defined as being available at least 85% of the time. It does not mean that 85% of the population of that grid cell can expect to receive the tested speed 100% of the time. Although the Alaska Plan Order required mobile-provider participants to commit to a minimum download and upload speed(s), we do not expect mobile-provider participants to meet the minimum speed requirements on

every single test, given that the performance of wireless networks is highly variable. Accordingly, we have set the pass rate at 85% to account for this variability.

45. To the extent that GCI may intimate that the 85% pass rate is too high, we do not alter it. The 85% pass rate we adopt for the Alaska Plan drive tests is similar to—but more lenient than—both the propagation modeling standard and the on-the-ground challenge data threshold adopted for the Broadband Data Collection. In the Second Report and Order in that proceeding, the Commission defined the parameters that service providers must use when modeling whether broadband is available using technology-specific minimum download and upload speeds with a cell edge probability of at least 90% and assuming minimum 50% cell loading. Additionally, mobile providers that submit on-the-ground speed test data to rebut a challenge to their coverage data are required to meet analogous thresholds to those required of challengers and demonstrate that sufficient coverage exists at least 90% of the time through a challenged area. These defined parameters in the Broadband Data Collection are more stringent than the propagation coverage relied on for the Alaska Plan drive test methodology, which uses the provider-defined propagation coverage from Form 477. Given that the provider has more discretion to set coverage parameters more favorably for itself in its Form 477 filings, it would have actually been appropriate for us to adopt a higher pass rate percentage than the Broadband Data Collection; we nonetheless adopt the 85% pass rate here to eliminate all doubt about the fairness of the pass rate. Neither GCI nor CVW propose an alternative percentage as more appropriate for the pass rate as applied by the model. We find compelling reasons to adopt an 85% pass rate, as we proposed, for Alaska Plan drive test data.

46. GCI argues that it should receive partial credit for the percentage of tests recorded above the minimum threshold when that percentage is below 85%. GCI states that "rather than applying the 85 percent pass rate as an 'all or nothing' bar for allowing a cell to be deemed covered, pops could count toward the commitment levels in proportion to the speeds that the speed tests confirm." GCI provides the example that, "if 50 percent of the drive tests show speeds at or above 10/1 Mbps and 50 percent of the tests show speeds of .2/.05 Mbps, then 50 percent of the pops associated

with that cell would count toward compliance with the 10/1 Mbps commitments, and 50 percent of the pops would count toward compliance with the <.2/.05 Mbps commitments."

47. We do not find GCI's arguments persuasive. Our statistical framework is designed around grid cells being the smallest unit of testing and is not designed to measure partial grid cells. GCI's example of counting a 50% pass rate as indicative of 50% of the population receiving service is an incorrect interpretation of what testing represents—rather, a 50% pass rate indicates that service is available 50% of the time. Further, GCI's proposal to count failed tests toward a lesser standard is incompatible with random sampling as it would apply results to a standard that was not selected for testing in a given grid cell. This would mean that results are no longer random.

48. Moreover, GCI and CVW committed to provide "minimum expected upload/download speeds" in their performance plans. In addition, GCI was the only provider to emphasize in its performance plans that it would be responsible for this minimum speed throughout all of its committed-to coverage area to the edge. Thus, GCI's own commitments emphasize that it needs to provide the minimum speeds throughout the coverage area of the specified commitment and should not receive partial credit to the extent it did not provide its minimum committed-to speed to the edge of such coverage.

49. In addition, GCI's suggested "partial credit" approach would require an alternative drive-test methodology with a corresponding assessment regarding how that methodology would be "statistically significant." But GCI does not provide a usable alternative methodology to replace the proposed drive test model. GCI's edit to the proposed drive-test methodology lacks a statistical basis from which, based on a limited set of tests, we could infer whether GCI had met its commitments. Partial credit also is inconsistent with the approach adopted in the Broadband Data Collection proceeding.

50. Finally, while we acknowledge that service declines farther away from the cell site, this service quality deterioration can be addressed in a number of ways, including adding more cell sites. GCI receives support to meet its commitments, and if it does not meet them initially, the drive tests can

help it understand where improvements are needed in its network, which will help it deliver the services it committed to Alaskans.

b. No Lower Speed Tier Credit for Failed Grid Cells

51. The Alaska Drive-Test Model's use of frames will allow providers to separately test the areas where they committed to different minimum speeds based on middle-mile availability and last-mile technology used, consistent with how the providers delineated these speeds in their performance plans. In doing so, the Alaska Drive-Test Model will ensure that the drive tests yield data that allow Commission staff to assess whether the providers have met their commitments.

52. GCI expressed concern that the Alaska Drive-Test Model disregards data that show improvement, if fewer than 85% of tests in a grid cell are below the minimum speed threshold for a frame. GCI provided the example that, "if 80 percent of tests in a cell reflect speeds of 10/1 Mbps, and 20 percent of tests reflect speeds of 9/1 Mbps, the cell is deemed unserved at any speed—even though all tests reported far faster speeds than required in the next lower speed tier (2/.8 Mbps.)." Where GCI fails a 4G LTE/3G grid cell for 4G LTE, GCI argued that, if the speeds are sufficiently above the 3G commitment, the grid cell should be a "pass" for the 3G frame.

53. Where a grid cell is selected for only 4G LTE testing, we cannot credit the grid cell to 3G if it fails the 4G LTE speed tier. This suggestion, if adopted, would result in an under-sampling for the 4G LTE frame and an oversampling for the 3G frame. Further, this would have the effect of removing population from one frame and adding it to a different frame, thereby disturbing the original distribution of the grid cells across stratum as calculated prior to testing. For example, suppose there is a grid cell for which one of the providers has claimed 100 people are covered by 4G LTE, but for which testing shows only 80% of the results exceed the minimum performance threshold. GCI's proposal would reallocate the population from the 4G LTE frame (and the stratum within the 4G LTE frame to which that grid cell is assigned) to a different frame and stratum for which the testing would show that the performance benchmarks have been met (in this case, the 3G frame). However, as the stratification and sample allocation processes primarily consider population, this would mean that, after testing was

completed, the total populations of the strata would have changed and, accordingly, the strata within each frame would no longer have the correct distribution of grid cells. Additionally, the number of samples optimally selected in each frame would also no longer be correct. This, in turn, would mean that the results could no longer be measured at the specified 90% confidence interval the Alaska Drive-Test Model sets for statistical significance.

c. Waterfall Model

54. For the reasons described above, the Alaska Drive-Test Model does not allow for partial credit where a mobile-provider participant fails a test in a higher performance tier. Frames are created based on the population covered at a particular minimum speed by technology from FCC Form 477 data set plus additional middle-mile data. If, however, the FCC Form 477 data show population coverage beyond what is committed to at the five-year mark, then the testing of that frame could show that the mobile-provider participant covered more people than it committed to in its performance plan. Where this happens, the commitments for the next lower tier last-mile technology will be accredited with the excess covered population of the higher technology tier.

55. GCI suggests that it should receive partial credit for providing service at lower speeds if it does not meet the 85% successful testing standard at the sampled technology, and for support, it cites to the Alternative Connect America Model (ACAM) waterfall methodology. For the ACAM waterfall methodology, a provider must satisfy a particular number of locations at a particular speed tier, and if a provider satisfies more than that, then the credit flows to the satisfaction of the next lower speed tier. For example, if 60 locations need to have 25/3 Mbps performance, 10 locations must have 10/1 Mbps performance, and 30 locations must have 4/1 Mbps performance, and the provider supplies 80 locations with 25/3 Mbps, then the 25/3 Mbps and 10/1 Mbps speed tier commitments would be fully satisfied, and 4/1 Mbps speed tier would be partially satisfied.

56. The ACAM waterfall methodology does not, as GCI suggests, support allowing failed performance at higher speed tiers and receiving credit for those failed tests in the lower speed tiers. The ACAM waterfall methodology requires complete satisfaction of the higher performance tier, and if

the provider connects locations beyond the minimum required in the higher performance tier, the excess coverage would flow down to the next level tier. If the provider does not completely satisfy the higher tier, then no excess is present, and no "waterfall" occurs: the provider needed to deploy to more locations in that tier and does not receive credit in other tiers for this failure. GCI's proposal is thus inconsistent with the ACAM waterfall methodology.

57. The Alaska Drive-Test Model, as originally proposed and adopted here, includes a waterfall methodology similar to the one used in ACAM that is tailored to the drive-test requirement. Specifically, where a provider has committed to multiple tiers of technology (i.e., 2G, 3G, and 4G LTE), any excess coverage would be applied to the next lower tier of technology. In the Alaska Drive Test Public Notice, the Bureau provided the example: "if a provider has committed to cover 25,000 people with 4G LTE and the upper limit of the confidence interval shows adequate coverage for 30,000 people, then the remaining 5,000 [population] coverage can be applied to its 3G commitment." The Alaska Drive Test Public Notice further stated that "[t]his process is iterative, so any further excess coverage can be applied to its 2G commitment." In other words, the Alaska Drive-Test Model includes a waterfall methodology that would credit lower tier commitments when there is excess performance of the higher tier commitments.

IV. PROCEDURAL MATTERS

A. Final Regulatory Flexibility Certification

58. The Regulatory Flexibility Act of 1980, as amended (RFA), requires that a regulatory flexibility analysis be prepared for notice-and-comment rule making proceedings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities." The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act. A "small business concern" is one which: (1) is independently owned and

operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).

59. An Initial Regulatory Flexibility Certification (IRFC) was incorporated in the Notice in this proceeding. In the Notice, the Bureau observed that the drive testing proposals required by the Alaska Plan apply only to wireless participants receiving more than $5 million in annual Alaska Plan support, excluding the smaller wireless participants that receive less than that amount in annual support. And, the proposals, if adopted, would apply to only two entities, one of which does not qualify as a small entity. Therefore, we certify that the requirements of the Order will not have a significant economic impact on a substantial number of small entities.

60. The Commission will send a copy of the Order, including a copy of the Final Regulatory Flexibility Certification, in a report to Congress pursuant to the Congressional Review Act. In addition, the Order and this final certification will be sent to the Chief Counsel for Advocacy of the SBA and will be published in the Federal Register.

B. Congressional Review Act

61. The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs, that this rule is “non-major” under the Congressional Review Act, 5 U.S.C. 804(2). The Commission will send a copy of this Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. 801(a)(1)(A).

V. ORDERING CLAUSES

62. Accordingly, IT IS ORDERED, pursuant to the authority contained in Sections 1 through 4, 201, 254, 301, 303, 307, 309, 332 of the Communications Act of 1934, as amended, 47 U.S.C. 151 through 154, 201, 254, 301, 303, 307, 309, 332 and Sections 0.91, 0.131, 0.291, 0.311, 54.317, 54.320, and 54.321 of the Commission’s rules, 47 CFR 0.91, 0.131, 0.291, 0.311, 54.317, 54.320, and 54.321, and the delegated authority contained in the Alaska Plan Order, 31 FCC Rcd 10139, 10160, 10166 through 67, paras. 67, 85, this Order IS ADOPTED, effective 30 days after publication in the Federal Register,

except that the deadline for filing updated coverage data shall be on 10 days after the adoption of the Order in accordance with the Public Notice.

63. IT IS FURTHER ORDERED that the Office of the Managing Director, Performance Evaluation and Records Management, SHALL SEND a copy of this Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, 5 U.S.C. 801(a)(1)(A).

64. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Order and Request for Comment, including the Initial Regulatory Flexibility Certification and the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Amy Brett
Acting Chief of Staff
Wireless Telecommunications Bureau

APPENDIX A

Mobile Speed Test Data Specification

1. Overview

The Alaska Plan requires certain plan participants to conduct and report speed tests of their networks, as described in this Order and appendices. Appendix A describes the data to be collected and the format in which it is to be reported.

2. Sample Data


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{
  "submission_type": "Alaska Plan",
  "submissions": [
   {
    "test_id": "1599236609",
    "device_type": "Android",
    "manufacturer": "Google",
    "model": "PIXEL 6",
    "operating_system": "Android 12",
    "device_tac": "35142059",
    "app_name": "FCC Speed Test app",
    "app_version": "2.0.4058",
    "provider_name": "GCI",
    "tests": {
      "download": {
       "timestamp": "2021-07-08T09:02:42-08:00",
       "warmup_duration": 3000622,
       "warmup_bytes_transferred": 31900808,
       "duration": 4997185,
       "bytes_transferred": 97382448,
       "bytes_sec": 19487461,
       "locations": [
        {
          "timestamp": "2021-07-08T09:02:42-08:00",
          "latitude": 63.069168,
          "longitude": -153.248195
        },
        {
          "timestamp": "2021-07-08T09:02:47-08:00",
          "latitude": 63.069168,
          "longitude": -153.248195
        }
       ],
       "cells": [
        {
          "cell_id": 32193025,
          "physical_cell_id": 192,
          "cell_connection": 1,
          "network_generation": "4G",
          "network_subtype": "LTE",
          "rssi": -77.1,
          "rsrp": -95.2,
          "rsrq": -16.5,
          "sinr": 11.9,
```

```
          "ec_io": -8.3,
          "rcsp": -84.2,
          "cqi": 10,
          "spectrum_band": 66,
          "spectrum_bandwidth": 20,
          "arfcn": 66786
        },
        {
          "cell_id": 10283265,
          "physical_cell_id": 101,
          "cell_connection": 2,
          "network_generation": "4G",
          "network_subtype": "LTE",
          "rssi": -77.1,
          "rsrp": -97.2,
          "rsrq": -10.1,
          "sinr": 21.2,
          "ec_io": -8.3,
          "rcsp": -84.2,
          "cqi": 10,
          "spectrum_band": 71,
          "spectrum_bandwidth": 15,
          "arfcn": 68686
        }
      ],
      "success_flag": true
    },
    "upload": {
      "timestamp": "2021-07-08T09:02:51-08:00",
      "warmup_duration": 3000213,
      "warmup_bytes_transferred": 8337402,
      "duration": 5000085,
      "bytes_transferred": 15129062,
      "bytes_sec": 3025761,
      "locations": [
        {
          "timestamp": "2021-07-08T09:02:51-08:00",
          "latitude": 63.069168,
          "longitude": -153.248195
        },
        {
          "timestamp": "2021-07-08T09:02:56-08:00",
          "latitude": 63.069168,
          "longitude": -153.248195
        }
      ],
      "cells": [
        {
          "cell_id": 32193025,
          "physical_cell_id": 192,
          "cell_connection": 1,
          "network_generation": "4G",
          "network_subtype": "LTE",
          "rssi": -77.1,
          "rsrp": -96.2,
          "rsrq": -9.1,
          "sinr": 10.5,
          "ec_io": -8.3,
          "rcsp": -84.2,
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          "spectrum_band": 66,
          "spectrum_bandwidth": 20,
          "arfcn": 66786
```

```
        },
        {
          "cell_id": 35988099,
          "physical_cell_id": 192,
          "cell_connection": 2,
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          "network_subtype": "LTE",
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          "rsrp": -99.1,
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          "rcsp": -84.2,
          "cqi": 10,
          "spectrum_band": 41,
          "spectrum_bandwidth": 20,
          "arfcn": 39874
        }
       ],
       "success_flag": true
      }
    }
   }
  ]
}
```


3. Mobile Speed Test Data

This section details the data structure common for all mobile speed test data in the Alaska Plan. This file contains records of each mobile speed test in JavaScript Object Notation (JSON) format matching the specification in the table and sections below:

Field	Data Type	Example	Description / Notes
submission_type	Enumerated	Alaska Plan	Type of data submission. *- Value must be "Alaska Plan".*
submissions	Array [Submission Object]		List of drive-test data submissions. *Note: the specification for the Submission Object is described in **Section a**.*

a. Submission Object

Field	Data Type	Example	Description / Notes
test_id	String	1599236609	Unique identifier used by the app or entity to differentiate tests. *- Value must be unique across all data submitted by the same entity.*
device_type	Enumerated	Android	Type of device. *- Value must be one of the following:* *{iOS|Android|Other}*
manufacturer	String	Google	Name of the device manufacturer.

Field	Data Type	Example	Description / Notes
model	String	PIXEL 6	Name of the device model.
operating_system	String	Android 12	Name and version of the device operating system.
device_tac	String	35142059	8-digit Type Allocation Code of the device. *- Value is not available on iOS and may be null for these device types.* *- Value may be null if the device does not return a valid value or else returns a value of unknown.*
app_name	String	FCC Speed Test app	Name of the mobile speed test app.
app_version	String	2.0.4058	Version of the mobile speed test app.
provider_name	String	GCI	Name of the mobile service provider.
tests	Test Object		Information about the test metrics. *Note: the specification for the Test Object is described in **Section b**.*

b. Test Object

Field	Data Type	Example	Description / Notes
download	Download Test Object		Information about the download test metric. *Note: this object is only required for 3G, 4G LTE, and 5G-NR network generation speed tests and would be omitted for 2G network generation voice tests.* *Note: the specification for the Download Test Object is described in **Section c**.*
upload	Upload Test Object		Information about the upload test metric. *Note: this object is only required for 3G, 4G LTE, and 5G-NR network generation speed tests and would be omitted for 2G network generation voice tests.* *Note: the specification for the Upload Test Object is described in **Section d**.*
voice_ terminating	Mobile Terminating Voice Test Object		Information about the mobile terminating voice test metric. *Note: this object is only required for 2G network generation voice tests and would be omitted for 3G, 4G LTE, and 5G-NR speed tests.* *Note: the specification for the Mobile Terminating Voice Test Object is described in **Section e**.*

Field	Data Type	Example	Description / Notes
voice_ originating	Mobile Originating Voice Test Object		Information about the mobile originating voice test metric. *Note: this object is only required for 2G network generation voice tests and would be omitted for 3G, 4G LTE, and 5G-NR speed tests.* *Note: the specification for the Mobile Originating Voice Test Object is described in **Section f**.*

c. Download Test Object

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:42-08:00	Timestamp of the time at which the test metric commenced. *- Value must match valid ISO-8601 format, including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
warmup_ duration	Integer	3000622	Duration in microseconds that connection took to stabilize (e.g., TCP slow start) before the test metric commenced.
warmup_bytes_ transferred	Integer	31900808	Measured total amount of data in bytes that were transferred during the period the connection took to stabilize (e.g., TCP slow start) before the test metric commenced.
duration	Integer	4997185	Duration that the test metric took to complete in microseconds.
bytes_transferred	Integer	97382448	Measured total amount of data in bytes that the test metric transferred.
bytes_sec	Integer	19487461	Measured number of bytes per second that the test metric transferred.
locations	Array [Location Object]		List of geographic coordinates of the locations measured during the speed test. *Note: the specification for each Location Object element is described in **Section g**.*
cells	Array [Cell Object]		List of cellular telephony information measured during the speed test. *Note: the specification for each Cell Object element is described in **Section h**.*
success_flag	Boolean	true	Boolean flag indicating whether the test completed successfully and without a change in state or connectivity.

d. Upload Test Object

Field	Data Type	Example	Description / Notes

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:51-08:00	Timestamp of the time at which the test metric commenced. *- Value must match valid ISO-8601 format, including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
warmup_ duration	Integer	3000213	Duration in microseconds that connection took to stabilize (e.g., TCP slow start) before the test metric commenced.
warmup_bytes_ transferred	Integer	8337402	Measured total amount of data in bytes that were transferred during the period the connection took to stabilize (e.g., TCP slow start) before the test metric commenced.
duration	Integer	5000085	Duration that the test metric took to complete in microseconds.
bytes_transferred	Integer	15129062	Measured total amount of data in bytes that the test metric transferred.
bytes_sec	Integer	3025761	Measured number of bytes per second that the test metric transferred.
locations	Array [Location Object]		List of geographic coordinates of the locations measured during the speed test. *Note: the specification for each Location Object element is described in **Section g**.*
cells	Array [Cell Object]		List of cellular telephony information measured during the speed test. *Note: the specification for each Cell Object element is described in **Section h**.*
success_flag	Boolean	true	Boolean flag indicating whether the test completed successfully and without a change in state or connectivity.

e. Mobile Terminating Voice Test Object

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:42-08:00	Timestamp of the time at which the test metric commenced. *- Value must match valid ISO-8601 format, including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
duration	Integer	2001681	Duration that the test metric took to complete in microseconds. *- Value must be between 5000000 and 30000000 (i.e., between 5 and 30 seconds).*

Field	Data Type	Example	Description / Notes
locations	Array [Location Objects]		List of geographic coordinates of the location(s) measured during the test. *Note: the specification for each Location Object element is described in **Section g**.*
cells	Array [Cell Objects]		List of cellular telephony information measured during the test. *Note: the specification for each Cell Object element is described in **Section h**.*
success_flag	Boolean	true	Boolean flag indicating whether the test completed successfully and without a change in state or connectivity.

f. Mobile Originating Voice Test Object

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:42-08:00	Timestamp of the time at which the test metric commenced. *- Value must match valid ISO-8601 format, including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
duration	Integer	2005309	Duration that the test metric took to complete in microseconds. *- Value must be between 5000000 and 30000000 (i.e., between 5 and 30 seconds).*
locations	Array [Location Objects]		List of geographic coordinates of the location(s) measured during the test. *Note: the specification for each Location Object element is described in **Section g**.*
cells	Array [Cell Objects]		List of cellular telephony information measured during the test. *Note: the specification for each Cell Object element is described in **Section h**.*
success_flag	Boolean	true	Boolean flag indicating whether the test completed successfully and without a change in state or connectivity.

g. Location Objects

Each element of the “locations” array contains the geographic coordinates of the locations measured at the start and end of the speed test, as well as during the test (if measured).

Field	Data Type	Example	Description / Notes

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:58-08:00	Timestamp of the time at which the location was recorded. *- Value must match valid ISO-8601 format, including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
latitude	Numeric	63.069168	Unprojected (WGS-84) geographic coordinate latitude in decimal degrees of the reported location where the test was conducted. *- Value must have minimum precision of 6 decimal places.*
longitude	Numeric	-153.248195	Unprojected (WGS-84) geographic coordinate longitude in decimal degrees of the reported location where the test was conducted. *- Value must have minimum precision of 6 decimal places.*

h. Cell Objects

Each element of the "cells" array contains telephony information about the cell / carrier.

Field	Data Type	Example	Description / Notes
timestamp	Datetime	2021-07-08T09:02:42-08:00	Timestamp of the time at which the cell information was measured. *- Value must match valid ISO-8601 format including seconds and timezone offset, i.e.: YYYY-MM-DD[T]hh:mm:ss±hh:mm*
cell_id	Numeric	32193025	Measured cell identifier. *- Value is not available on iOS and may be null for these device types.*
physical_cell_id	Integer	192	Measured Physical Cell Identity (PCI) of the cell. *- Value is not available on iOS and may be null for these device types.* *- Value is only required for 4G LTE and 5G-NR tests and must be null for 2G or 3G tests.*

Field	Data Type	Example	Description / Notes
cell_connection	Enumerated	1	Connection status of the cell. - *Value must be one of the following codes:* *0 – Not Serving* *1 – Primary Serving* *2 – Secondary Serving* - *Value is not available on iOS and may be null for these device types.* - *Value may be null if the device does not return a valid value or else returns a value of unknown.*
network_ generation	Enumerated	4G	String representing the network generation of the cell. - *Value must be one of the following:* *{2G|3G|4G|5G|Other}*
network_subtype	Enumerated	LTE	String representing the network subtype of the cell. - *Value must be one of the following:* *{1X|EVDO|WCDMA|GSM|HSPA|HSPA+|LTE|NRSA|NRNSA}*
rssi	Decimal	-57.2	Measured Received Signal Strength Indication (RSSI) in dBm of the cell. - *Value is not available on iOS and may be null for these device types.* - *Value is required for all network generations and subtypes.*
rxlev	Decimal	-80.2	Measured Received Signal Level in dBm of the cell. - *Value is not available on iOS and may be null for these device types.* - *Value is only required for tests with a network generation and subtype of 2G – GSM, and must be null for all other network generations or subtypes.*
rsrp	Decimal	-92.1	Measured Reference Signal Received Power (RSRP) in dBm of the cell. - *Value is not available on iOS and may be null for these device types.* - *Value must be null for 2G or 3G tests.* - *Note: this value represents the Synchronization Signal (SS) for 5G-NR tests and the Channel-specific Reference Signal (CRS) for 4G LTE tests.*

Field	Data Type	Example	Description / Notes
rsrq	Decimal	-12.5	Measured Reference Signal Received Quality (RSRQ) in dB of the cell. *- Value must be null for 2G or 3G tests.* *- Note: this value represents the Synchronization Signal (SS) for 5G-NR tests and the Channel-specific Reference Signal (CRS) for 4G LTE tests.*
sinr	Decimal	21.3	Measured Signal to Interference and Noise Ratio (SINR) in dB of the cell. *- Value is not available on iOS and may be null for these device types.* *- Value may be null for 2G or 3G tests.* *- Note: this value represents the Synchronization Signal (SS) for 5G-NR tests and the Channel-specific Reference Signal (CRS) for 4G LTE tests.*
rxqual	Integer	3	Measured Received Signal Quality of the cell *- Value is not available on iOS and may be null for these device types.* *- Value must be between* 0 and 7. *- Value is only required for tests with a network generation of 2G and network subtype of GSM, and must be null for all other network generations or network subtypes.*
ec_io	Decimal	-8.3	Measured Energy per Chip to Interference Power Ratio in dB of the cell. *- Value is not available on iOS and may be null for these device types.* *- Value is only required for CDMA 1X, EVDO, WCDMA, HSPA, and HSPA+ network subtypes, and must be null for all other network subtypes.*
rscp	Decimal	-87.2	Measured Received Signal Code Power in dBm of the cell. *- Value is not available on iOS and may be null for these device types.* *- Value is only required for WCDMA, HSPA, and HSPA+ network subtypes, and may be null for all other network subtypes.*

Field	Data Type	Example	Description / Notes
cqi	Integer	11	Measured Channel Quality Indicator (CQI) of the cell. *- Value is not available on iOS and may be null for these device types.* *- Value is only required for WCDMA, HSPA, HSPA+, LTE, and NR network subtypes, and may be null for all other network subtypes.*
spectrum_band	Integer	66	Spectrum band used by the cell. *- Value is not available on iOS and may be null for these device types.* *- Value may be null for 2G or 3G tests.* *- Value may be null if the device does not return a valid value or else returns a value of unknown.* *- Note: the reported band value corresponds to the Operating Bands tables as follows:* *- 4G LTE: 3GPP TS 36.101 section 5.5* *- 5G-NR: 3GPP TS 38.101 table 5.2-1*
spectrum_bandwidth	Numeric	15	Total amount of spectral bandwidth used by the cell in MHz. *- Value is not available on iOS and may be null for these device types.*
arfcn	Integer	66786	Absolute radio-frequency channel number, measured absolute physical RF channel number of the cell. *- Value is not available on iOS and may be null for these device types.*

APPENDIX B

Drive-Test Procedures for Alaska Drive-Test Model—Technical Appendix

I. INTRODUCTION

This technical appendix provides the process for Alaska Plan mobile service providers receiving more than $5 million annually in support to gather drive testing data to include with its performance plan milestone certifications. The Alaska Plan requires such testing to include "a statistically significant number of tests in the vicinity of residences being covered" to demonstrate that plan participants have met the commitments in the performance plans approved by the Wireless Telecommunications Bureau (Bureau).

Remote Alaska is extraordinarily sparsely populated; virtually all its county-level geographies have population densities of three or fewer people per square mile. Accordingly, testing every location for a provider's coverage would be unduly burdensome, and testing a sample of locations is required.

For the sampling required to implement the testing procedures under the Alaska Plan, the Alaska Drive-Test Model uses stratified random sampling. This sampling methodology balances between the statistical significance required by the Alaska Plan and the burden on providers to conduct tests from a sufficient number of locations.

The following sections describe the details of the testing process. These technical details serve as a guide to both the Bureau and the providers doing the testing in determining:

- where, within the geographic boundaries of the coverage map, a provider should conduct testing;
- how many locations a provider must test;
- what speed test measurements will be accepted for staff analysis by the Bureau; and
- how Bureau staff will evaluate the test data and adjudicate whether the provider has passed or failed the testing process.

II. SAMPLE FRAME CONSTRUCTION

To select locations for testing, one must first construct a list (known as a "sampling frame" or "frame") of possible locations to select from. The construction of this frame is a multi-part process. First, we will create a set of "eligible populated areas." Census blocks eligible for frozen-support funding would be included, and these census blocks would be merged with the populated areas of the Alaska Population-Distribution Model. Second, staff will merge the FCC Form 477 reported coverage areas (for which a provider committed to deploy and that are subject to testing) with the eligible populated areas to create a set of "covered populated areas." Third, staff will overlay a grid of 1 km x 1 km squares onto the covered populated areas. Due to the fact that the Alaska Population-Distribution Model uniformly distributes population within the populated areas of a census block, the covered populated areas of a block likewise have a uniform population distribution. The total population of each grid cell is the sum of the populations of the covered populated areas contained within a given grid cell. For example, if a grid cell contains 25% of the covered populated area of a census block, that grid cell would be credited with 25% of that block's covered population. That same grid cell might also contain 100% of a second census block's covered populated area. So all of that census block's covered population would be credited to that grid cell, and the grid cell's total population will be the sum of these two populations. Lastly, any grid cell that contains fewer than 100,000 square meters of covered populated area, or 10% of the grid cell, will be excluded from the frame.[1] This ensures that all grid cells have a reasonable testable area, reducing burden on providers. Grid cells with smaller levels of covered populated area are less likely to have areas that are publicly accessible or large enough to conduct mobile testing. Figures 1-4 below detail this process.

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[1] For clarification, the population of grid cells with a *de minimis* populated area will be credited towards the commitments represented by the frames from which the respective grid cells were removed. For example, a grid cell that was removed from a frame measuring fiber-based 4G LTE at 10/1 Mbps because it had a testable area of less than 100,000 square meters would have its population credited towards that provider's fiber-based 4G LTE at 10/1 Mbps commitment.

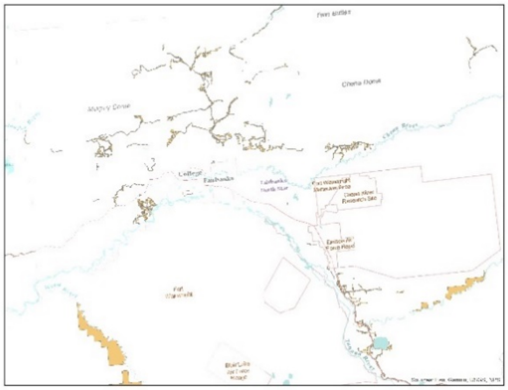

Fig. 1: Eligible Blocks and Populated Areas

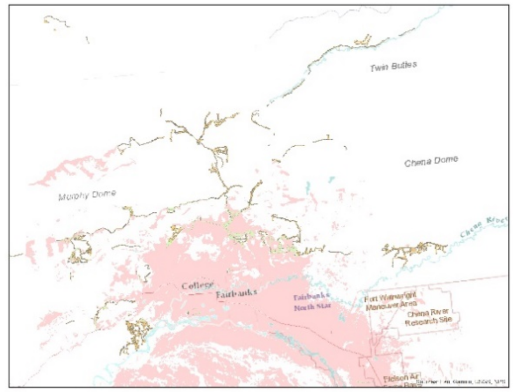

Fig. 2: Eligible Populated Areas and Coverage

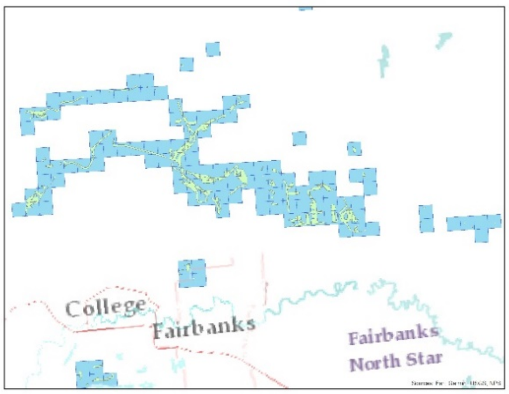

Fig. 3: Covered Populated Areas with Grid

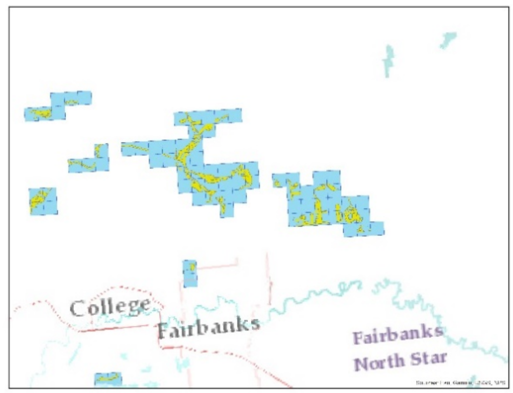

Fig 4: Grid Cells Eligible for Selection

For commitments that do not promise different speeds for different middle-mile technologies, staff will construct the frame based on the reported technology coverage from the provider's FCC Form 477 submission. For areas served by more than one technology, as reported on the FCC Form 477, staff will only include the latest generation technology in the frame for any areas covered by multiple technologies. For example, if an area is covered by both 2G and 3G, then the area will only be included in the 3G frame. As no commitments were made for 5G-NR service, any 5G-NR coverage would be included within the LTE frame.[2] Where a provider has committed to different speeds in different areas

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[2] If a provider's FCC Form 477 submissions show more than one level of speed for a given technology, then only the area of the submission with speeds equaling or exceeding the committed service will be included in that frame, with the rest of the area included in the frame of the lower last-mile technology. For example, if a provider has committed to LTE at 10/1 Mbps speeds, and shows in its FCC Form 477 LTE submission areas that have 10/1 Mbps LTE speeds, and other areas with 5/1 Mbps speeds, only the 10/1 Mbps areas would be included in the LTE frame, while the 5/1 Mbps areas would be instead included in the 3G frame, which could also be described as "3G or better." This will prevent a provider who has begun upgrading an area's service, but that has not yet finished the upgrade, from being penalized by having it tested against a standard of a fully upgraded service area.

due to different middle-mile technologies, the frame would rely on additional data submitted by the provider to differentiate the covered areas of a given technology (e.g., LTE) with multiple middle-mile types.

III. FRAME STRATIFICATION

Frame stratification is the process of dividing a frame into subsets of similar characteristics, called strata. This methodology allows fewer grid cells to be selected for testing while producing the statistically equivalent level of accuracy as sampling the entire frame, thus reducing testing burden.

The number of strata for each frame depends on the number of grid cells in a given frame. To create the strata, the Bureau will use the cumulative square root of the frequency (CSRF) method, based on grid-level estimates of covered population. CSRF is a standard stratification method used to define the breaks between strata. It creates equal intervals not on the scale along the stratification variable (in this case, covered population) scale, but rather on the scale along the cumulated square root of the count (frequency) of grid cells belonging to equal intervals of the stratification variable. The first stratum in each frame would contain all grid cells with a population of less than one.

Based on the data staff currently have, each frame will likely contain between two and eight strata. Staff analysis has found that this stratification method produces strata of more equal sizes than other potential stratification methods (e.g., based on census tracts), which reduces the number of grid cells that need to be selected for testing.

Further, staff will select certain grid cells with probability 1 (grid cells that are called certainties) within each stratum. This ensures that grid cells that have a high population within a given stratum are tested; this should prevent the testing results of the stratum from being skewed by outlier results from low-weighted grid cells.

IV. SAMPLE SIZE CALCULATION AND ALLOCATION AND SAMPLE SELECTION

The Bureau will determine the number of grid cells that the provider has to test (that is, the sample size, n), based on two statistical assumptions. The first is that the variance of the desired estimate of average population served cannot exceed a specified value, V. The second is that the cost of drive testing is constant in every grid cell selected in the sample. Under these assumptions, a theoretical value for the sample size can be calculated as detailed below.

Let L denote the number of strata in the frame and let the index h distinguish these L strata. Further, denote or define the following quantities:

- Number of grid cells in the stratum $= N_h$ (thus, $N = \sum_{h=1}^{L} N_h$)
- Weight of the stratum $= W_h = N_h/N$
- Mean of X in the stratum $= \bar{X}_h = \frac{1}{N_h}\sum_{i=1}^{N_h} X_{h,i}$ where $X_{h,i}$ is the value of committed population X in the ith grid cell of stratum h
- Variance of X in the stratum $= V(X)_h = \frac{\sum_{i=1}^{N_h} (X_{h,i} - \bar{X}_h)^2}{N_h - 1}$

Under our proposal, the theoretical minimum sample size is given by:

$$n = \frac{\left(\sum_{h=1}^{L} W_h \sqrt{V(X)_h}\right)^2}{V + (1/N)\sum_{h=1}^{L} W_h V(X)_h}$$

Once determined, n would be allocated among the different strata. Specifically, if n_h is the number of sample grid cells allocated to the stratum, then:

$$n_h = n\frac{W_h\sqrt{V(X)_h}}{\sum_{h=1}^{L} W_h\sqrt{V(X)_h}} = n\frac{N_h\sqrt{V(X)_h}}{\sum_{h=1}^{L} N_h\sqrt{V(X)_h}}$$

This method of apportioning the sample among the various strata is called Neyman allocation. This method will assign a greater number of sampled grid cells to strata with higher populations rather than lower populations. Note that $n = \sum_{h=1}^{L} n_h$.

Guided by the allocation scheme from the previous section, staff will use geographic information systems (GIS) tools or statistical software to randomly select grid cells in each stratum. Staff will then conduct a four-step optimization analysis, as follows.

First, we will draw a sample according to the adopted stratified random design. If there are multiple frames for a provider, we will sample independently from each frame. These multiple samples will be subjected to the rest of the optimization steps together as one set. We will then repeat this process at least one hundred times, each time yielding a sample, or group of samples, that are valid under the design.

Second, from this set of valid samples, we will identify the sample or samples with grid cells that contain the least number of incorporated and census-designated places.

Third, if there are multiple samples identified in the previous step, we will then determine which of the remaining samples contains the fewest number of selected grids that are located outside of incorporated and census-designated places.

Fourth, if there remains more than one sample identified in the previous step, we will randomly pick one.

The optimal sample so identified likely will result in a significant reduction in the number of communities that have to be visited for the required testing. The provider subject to testing will be notified of the sample grid cells in which it will be required to conduct on-the-ground speed tests.[3]

V. DRIVE-TESTING DATA COLLECTION

Within each selected grid cell, a carrier must conduct a minimum of 20 tests, no less than 50% of which are to be conducted while in motion from a vehicle. This is the minimum number of tests to support the use of the binomial distribution to approximate the normal distribution that is needed in calculating the gap in coverage based on a one-sided 90% confidence interval, as discussed later in Section VII. To be considered valid, each test must be conducted between the hours of 6:00 a.m. and 10 p.m. local time, within the selected grid cell, and report all relevant parameters defined in Appendix A. Each component of a test (i.e., download and upload speeds) should have a duration between 5 and 30 seconds. Mobile tests are considered to be located within the grid cell containing the starting location, as a tester has full control over the starting location of a test but may not always be able to control the ending location of a test. Testers should, however, attempt to conduct a mobile test within a single grid cell as much as is

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[3] If a grid cell that is in multiple frames is randomly selected for testing more than once, the provider only needs to conduct one set of tests for that grid cell. The results can be used for all frames for which the grid cell was selected.

reasonably and safely possible. A mobile test should initiate when moving away from the location of a stationary test after having reached the speed of the surrounding traffic, or a safe and reasonable operating speed in the event no traffic is present.

VI. STATISTICAL ANALYSIS OF TESTING RESULTS

Upon receipt of drive-testing submissions, the Bureau will perform a statistical analysis of the data to estimate the desired total population covered. Because the sample is selected using stratified random sampling, estimation techniques appropriate for this particular sampling method must be used.

Stratified random sampling requires an aggregate measurement from a sampled grid cell that will be combined with measurements from the other sampled grid cells to calculate stratum-level estimates of total covered population. These estimates will, in turn, be combined to produce an overall estimate of covered population. Drive tests conducted in a sample grid cell will be aggregated based on the following rule:

> Let p be the percentage of drive tests that meet or exceed the applicable minimum. If p is at least 85%, then the full population of the sample grid cell will be deemed as covered; otherwise, 0% will be deemed as covered.

To calculate the stratum-level estimates and the overall estimate of the covered population, the Bureau will use the estimation method appropriate for stratified random sampling, described next.

Let $x_{h,i}$ be the (deemed) covered population in the ith grid cell of stratum h, where $\mathrm{i} = 1,\ldots,\mathrm{n_h}$. Based on the rule above, $x_{h,i} = X_{h,i}$ if $p \geq 0.85$, and $x_{h,i} = 0$ if $p < 0.85$. The stratum sample mean covered population, $\bar{\mathrm{x}}_\mathrm{h}$, is calculated as $\bar{\mathrm{x}}_\mathrm{h} = \sum_{\mathrm{i}=1}^{\mathrm{n_h}} \mathrm{x_{h,i}}/\mathrm{n_h}$; the stratum sample total covered population is $\mathrm{N_h}\bar{\mathrm{x}}_\mathrm{h}$; and the stratum sample variance, $s_h{}^2$, is calculated as $\mathrm{s_h}^2 = \frac{\sum_{\mathrm{i}=1}^{\mathrm{N_h}} (\mathrm{x_{h,i}} - \bar{\mathrm{x}}_\mathrm{h})^2}{\mathrm{n_h} - 1}$.

Combining these stratum-level estimates, we arrive at the overall covered population mean, $\bar{\mathrm{x}}$, calculated as:

$$\bar{x} = \sum_{h=1}^{L} \frac{N_h \bar{x}_h}{N} = \sum_{h=1}^{L} W_h \bar{x}_h$$

with variance:

$$V(\bar{x}) = \frac{1}{N^2} \sum_{h=1}^{L} N_h (N_h - n_h) \frac{{s_h}^2}{n_h}.$$

Finally, the overall covered population total, $\hat{X}$, is estimated as

$$\hat{X} = N\bar{x}.$$

VII. ADJUDICATION OF THE OUTCOME OF THE TESTING PROCESS

Because the estimate of the total covered population $\hat{X}$ comes from a sample, direct comparison of $\hat{X}$ against the committed covered population is not appropriate. Instead, staff will construct a confidence interval that takes into account the variability arising from the estimate $\hat{X}$ and use this confidence interval to adjudicate the outcome of the testing process.

Because the Alaska Plan calls for a tiered approach in levying penalties for providers failing the testing process, the Bureau will use a one-sided 90% confidence interval for $\hat{X}$ to quantify the gap in coverage. In particular, the Bureau will use the upper limit of this confidence interval, which is calculated as $\hat{X} + 1.28N\sqrt{V(\bar{x})}$. This will be added to the population of grid cells with a *de minimis* populated area that had been previously removed from the tested frame.

The compliance gap is then calculated as:

Gap in Coverage = Total Population Coverage Commitment $- (\hat{X} + 1.28N\sqrt{V(\bar{x})} +$ De Minimis Grid Cells).

If the gap in coverage is no more than 5% of the total population of a given commitment, no penalties will apply. Otherwise, penalties will apply according to the tiers adopted by the Commission.

Additionally, it is possible to have a negative gap in coverage if the upper limit of the confidence interval is greater than the total committed population. If a provider has committed to multiple tiers of technology (i.e., 2G, 3G, and 4G LTE), then any excess coverage, as defined by a negative gap in coverage, can be applied to the next lowest tier of technology. For example, if a provider has committed to cover 25,000 people with 4G LTE and the upper limit of the confidence interval shows adequate coverage for 30,000 people, then the remaining 5,000 coverage can be applied to its 3G commitment. This process is iterative, so any further excess coverage can be applied to its 2G commitment. Accordingly, the formula above would be re-written as:

Gap in Coverage = Total Population Coverage Commitment – ($\hat{X} + 1.28N\sqrt{V(\bar{x}\,)}$ + De Minimis Grid Cells + Excess Coverage from Higher Technology).

This methodology therefore will not punish carriers for improving coverage beyond what they committed.

APPENDIX C

Current Performance Plans

I. Copper Valley Wireless

Copper Valley Wireless, LLC

	Note 1		Note 2											
Middle Mile	Population 2010 Census	Spectrum Codes (477 Code)	Population Served 12/31/15	% Base Population Served 12/31/15	Technology Of Transmission (477 Code)	Minimum Expected Upload/ Download Speeds	5 Year Base Population Served	5 Year % Total Population Served	Technology Of Transmission (477 Code)	Minimum Expected Upload/ Download Speeds	10 Year Total Base Population Served	10 Year % Population Served	Technology Of Transmission (477 Code)	Minimum Expected Upload/ Download Speeds
Satellite	NA													
Microwave	2,426	90												
			2,377	98%	83	10MB/3MB	2,377	98%	83	10MB/3MB	2,377	98%	83	10MB/3MB
Fiber	6,708	90	202	3%	85	1MB/.8MB								
			6,171	92%	83	10MB/3MB	6,373	95%	83	10MB/3MB	6,373	95%	83	10MB/3MB

Note 1: Population per 2010 Census in service area. Excludes population served by AT&T and/or Verizon at 4G LTE using their infrastructure.
Note 2: Percentage of population served at benchmark speeds as of 12/31/15.
Note 3: Year 1 is 2017

II. GCI

GCI Alaska Plan PerformanceCommitments - Updated July 1, 2020

		Note 1		Note 2	Note 3		Note 4						
Middle Mile	Technology Of Transmission (477 Code)	Population 2010 Census	Population Served 12/31/15	% Base Population Served 12/31/15	5 Year Base Population Served	5 Year % Total Population Served	10 Year Total Base Population Served	10 Year % Population Served	Increase/ (Decrease) by Year 10	10 Year Total Population Served - Revised 7/1/20	10 Year % Population Served - Revised 7/1/20	Minimum Expected Download/ Upload Speeds at Edge	Spectrum Codes (477 Code)
Fiber	83 (LTE)	64,158	13,455	21%	32,079	50%	69,601	100%	-	69,601	100%	10/1 Mbps	90, 91, 93, 94
	80, 81, 82 (3G)		43,882	68%	25,258	39%	-	0%	-	-	0%	.2/.05 Mbps	90, 91, 93, 94
	85, 86 (Voice/2G)		6,821	11%	6,821	11%	-	0%	-	-	0%	<.2 Mbps	90, 91, 93, 94
Fiber Total			64,158	100%	64,158	100%	69,601	100%		69,601	100%		
Microwave	83 (LTE)	50,717	125	0%	125	0%	42,095	83%	402	42,497	83%	2/.8 Mbps	90, 91, 93, 94
	80, 81, 82 (3G)		29,764	59%	41,970	83%	8,622	17%	-	8,622	17%	.2/.05 Mbps	90, 91, 93, 94
	85, 86 (Voice/2G)		20,828	41%	8,622	17%	-	0%	-	-	0%	<.2 Mbps	90, 91, 93, 94
Microwave Total			50,717	100%	50,717	100%	50,717	100%		51,119	100%		
Satellite	83 (LTE)	24,482	-	0%	12,363	50%	8,150	43%	-	8,150	44%	1/.256 Mbps	90, 91, 93, 94
	80, 81, 82 (3G)		-	0%	-	0%	-	0%	-	-	0%	.2/.05 Mbps	90, 91, 93, 94
	85, 86 (Voice/2G)		24,482	100%	12,119	50%	10,889	57%	(402)	10,487	56%	<.2 Mbps	90, 91, 93, 94
Satellite Total			24,482	100%	24,482	100%	19,039	100%		18,637	100%		
Total	83 (LTE)		13,580	10%	44,567	32%	119,846	86%	402	120,248	86%		
Total	80, 81, 82 (3G)		73,646	53%	67,228	48%	8,622	6%		8,622	6%		
Total	85, 86 (Voice/2G)		52,131	37%	27,562	20%	10,889	8%	(402)	10,487	8%		
Grand Total		**139,357**	139,357	100%	**139,357**	100%	**139,357**	100%		**139,357**	100%		

Note 1: Population per 2010 Census in service area. Excludes population served by AT&T and/or Verizon at 4G LTE using their infrastructure.
Note 2: Percentage of population served at benchmark speeds as of 12/31/15.
Note 3: Year 1 is 2017.
Note 4: 10 year figures reflect commitments as revised on July 1, 2019.

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